

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Li Li, et al.

Application No.: Not Yet Assigned

Group Art Unit: 2815

Filed: August 28, 2001

Examiner: P. Brock

For: METHOD OF CONTROLLING
STRIATION AND CD LOSS IN CONTACT
OXIDE ETCH

FIRST PRELIMINARY AMENDMENT

Box Non-Fee Amendment
Commissioner for Patents
Washington, DC 20231

Dear Madame/Sir:

Prior to examination on the merits, please amend the above-identified U.S. patent application as follows:

In the Specification:

Page 1, before "Field of the Invention," please insert -- This application is a continuation of the Application Serial No. 09/292,393, filed on April 15, 1999, which is hereby incorporated by reference.--

In the Claims:

Please cancel claims 1-91.

Please add the following new claims:

92. (new) A method for etching an oxide layer of a substrate, comprising:
placing a substrate having an oxide layer formed over said substrate into a
reactive chamber;
introducing an etching gas into said chamber;
generating a plasma of said etching gas at a first power level and contacting said
oxide layer of said substrate with said first power level plasma for a first predetermined time;
and
generating a plasma of said etching gas at a second power level in said chamber
and contacting said oxide layer of said substrate with said second power level plasma for a
second predetermined time to etch said oxide layer, wherein said first and second power
levels are different.

93. (new) The method according to claim 92, wherein said first power level is
from about 100 Watts to about 250 Watts.

94. (new) The method according to claim 92, wherein said first power level is
about 150 Watts.

95. (new) The method according to claim 92, wherein said first predetermined
time is from about 3 seconds to about 10 seconds.

96. (new) The method according to claim 92, wherein said first predetermined
time is about 5 seconds.

97. (new) The method according to claim 92, wherein said second power level
is from about 800 Watts to about 1100 Watts.

98. (new) The method according to claim 92, wherein said second power level
is about 950 Watts.

99. (new) The method according to claim 92, wherein said second predetermined time is from about 30 seconds to about 260 seconds.

100. (new) The method according to claim 92, wherein said second predetermined time is about 60 seconds.

101. (new) The method according to claim 92, wherein said etching gas for said first power level plasma and said second power level plasma is selected from the group consisting of Cl₂, HBr, CF₄, CHF₃, CH₂F₂ and inert gases.

102. (new) The method according to claim 101, wherein said first power level plasma is formed of CF₄, CHF₃ and an inert gas.

103. (new) The method according to claim 101, wherein said second power level plasma is formed of CF₄, CHF₃ and an inert gas.

104. (new) The method according to claim 101, wherein said first power level and said second power level plasmas are formed of CF₄, CHF₃ and Ar.

105. (new) The method according to claim 101, wherein said first power level and said second power level plasmas are formed of CF₄, CHF₃ and He.

106. (new) The method according to claim 92, wherein said substrate is a silicon-based substrate.

107. (new) The method according to claim 92, wherein said substrate is a germanium substrate.

108. (new) The method according to claim 92, wherein said substrate is a gallium arsenide substrate.

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REMARKS/ARGUMENTS

This is a continuation application of the U.S. Application Serial No. 09/292,393 filed on April 15, 1999.

No new matter has been added to the specification. Claims 1-91 have been cancelled. Claims 92-108 have been added. Claims 92-108 are pending in this application.

The subject matter of claims 92-108 is not anticipated under the Yang et al. (U.S. Patent No. 6,159,794) (“Yang”) reference cited during the prosecution of the U.S. Application Serial No. 09/292,393. Yang does not disclose or suggest the limitations of claim 92-108. Yang does not disclose a method for etching an oxide layer of a substrate comprising the step of “generating a plasma of said etching gas at a first power level and contacting said oxide layer of said substrate with said first power level plasma for a first predetermined time” and “generating a plasma of said etching gas at a second power level and contacting said oxide layer of said substrate with said second power level plasma for a second predetermined time,” as independent claim 92 recites. Yang depicts a tunnel oxide 15 (col. 4, line 66; Figures 2-4) over substrate 12, but that oxide is not etched. In Yang, it is tungsten silicide layer 28 with its residue 64 that is subjected to the two plasmas 55 and 66, respectively, and not an oxide layer, as in the present invention. (Col. 7, lines 24-52, Figures 4a-4b). Accordingly, the subject matter of claims 92-108 is not anticipated by Yang.

In addition, the subject matter of claims 92-108 would not have been obvious over Yang. First, Yang does not teach or suggests all claim limitations. Yang teaches a “controlled multistage etching process for controlled removal of a tungsten silicide layer within the layer stack” (abstract), and not a method for “etching an oxide layer of a

substrate,” as independent claim 92 recites. Second, a person skilled in the art would not have been motivated to employ the plasma chemistries taught by Yang to etch an oxide layer of a substrate. Yang teaches plasmas having etching selectivities tailored only to the etching of a tungsten silicide layer relative to polysilicon, and not for the etching of an oxide layer. For example, Yang teaches a first etching process during which “part of the tungsten silicide layer is selectively etched away using a plasma that exhibits an etching selectivity (ratio of tungsten silicide etch rate to polysilicon etch rate) less than about 1.2.” (Abstract). Yang further teaches a second etching process during which “the remaining amount . . . of the tungsten silicide layer is selectively etched away using a plasma that exhibits an etching selectivity (ratio of tungsten silicide etch rate to polysilicon etch rate) greater than about 1.2.” (Abstract). Accordingly, a person skilled in the art would not have been motivated to employ the plasmas with different etching selectivities of Yang to etch the oxide layer of the claimed invention.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

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